ENTHALPY ANALYTICAL

Leaders in Environmental Toxicology & Chemistry

December 4, 2020

Aram Varjabedian
Woodard & Curran
Hull Water Pollution Control Facility
1111 Nantasket Avenue
Hull, Massachusetts 02045

Enclosed, please find a copy of our report presenting the results of toxicity tests completed using an effluent sample collected from the Hull, Massachusetts Water Pollution Control Facility during November 2020. Acute toxicity was evaluated using the inland silverside minnow, *Menidia beryllina*.

Please do not hesitate to call me should you have any questions regarding the report.

Sincerely,

Enthalpy Analytical, LLC

Meredith Wheeler
Project Manager

Enclosure:
WET Test Report Certification
Report Number 34676-20-11
Email Only

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION

Permittee Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____

_____

Authorized Signature

_____

Print or Type Name

Hull Permanent Sewer Commission

Print or Type the Permittee's Name

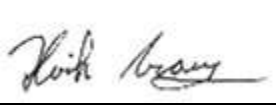
MA0101231

Type or Print the NPDES Permit No.

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION (Bioassay Laboratory)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: December 4, 2020



Meredith Wheeler

Digitally signed by Meredith Wheeler
DN: cn=Meredith Wheeler, o=Enthalpy Analytical, ou=Project Manager, email=Meredith.Wheeler@Enthalpy.com, c=US
Date: 2020.12.04 10:11:26 -05'00'

Kirk Cram
Laboratory Director - Enthalpy Analytical, LLC

TOXICOLOGICAL EVALUATION
OF A TREATED MUNICIPAL EFFLUENT
BIOMONITORING SUPPORT FOR A NPDES PERMIT:
November 2020

Hull Water Pollution Control Facility
Hull, Massachusetts
NPDES Permit Number MA0101231

Prepared For:

Woodard and Curran
Hull Water Pollution Control Facility
1111 Nantasket Avenue
Hull, Massachusetts 02045

Prepared By:

Enthalpy Analytical, LLC
One Lafayette Road
Hampton, New Hampshire 03842

November 2020
Reference Number: Hull34676-20-11

STUDY NUMBER 34676

EXECUTIVE SUMMARY

The following summarizes the results of an acute exposure bioassay completed during November 2020 in support of the NPDES biomonitoring requirements of the Hull, Massachusetts Water Pollution Control Facility operated by Woodard and Curran. The 48-hour acute definitive assay was conducted using the inland silverside, *Menidia beryllina*.

M. beryllina, supplied by Aquatic Biosystems, Inc., of Fort Collins, Colorado, were 13 days old at the start of the test. Dilution water was receiving water collected from the Massachusetts Bay upstream of, or away from, the discharge. Samples were received under chain of custody in good order. All sample receipt, test conditions and control endpoints were within protocol specifications, except where otherwise noted.

The results presented in this report relate only to the samples described on the chain(s) of custody and sample receipt log(s), and are intended to be used only by the submitter. Results from the acute exposure assay and their relationship to permit limits are summarized in the following matrix.

Acute Toxicity Evaluation

Species	Exposure	LC-50	A-NOEC	Permit Limit (LC-50)	Effluent Meets Permit Limit	Assay Meets Protocol Limits
Menidia beryllina	48 Hours	>100%	NC	≥100%	Yes	Yes

COMMENTS:
NC = Not Calculated.

TOXICOLOGICAL EVALUATION
OF A TREATED MUNICIPAL EFFLUENT
BIOMONITORING SUPPORT FOR A NPDES PERMIT:
November 2020

Hull Water Pollution Control Facility
Hull, Massachusetts
NPDES Permit Number MA0101231

1.0 INTRODUCTION

This report presents the results of an acute toxicity test completed on a composite effluent sample collected from the Hull, Massachusetts Water Pollution Control Facility (Hull WPCF) operated by Woodard and Curran. Testing was based on programs and protocols developed by the US EPA (2002), with exceptions as noted by US EPA Region I (2012), and involved conducting a 48-hour static acute toxicity test with the inland silverside minnow, *Menidia beryllina*. Testing was performed at Enthalpy Analytical, LLC (Enthalpy), Hampton, New Hampshire in accordance with the provisions of TNI Standards (2009).

Acute toxicity tests involve preparing a series of concentrations by diluting effluent with control water. Groups of test organisms are exposed to each effluent concentration and a control for a specified period. In acute tests, mortality data for each concentration are used to calculate the median lethal concentration, or LC-50, defined as the effluent concentration that kills half of the test organisms. Samples with high LC-50 values are less likely to cause significant environmental impacts. The no-effect concentration is also determined to provide information about the level of effluent that would have minimal acute effects in the environment. This Acute No Observed Effect Concentration (A-NOEC) is defined as the highest tested effluent concentration that causes no significant mortality.

2.0 MATERIALS AND METHODS

2.1 General Methods

Toxicological and analytical protocols used in this program follow procedures primarily designed to provide standard approaches for the evaluation of toxicological effects of discharges on aquatic organisms (US EPA 2002), and for the analysis of water samples (APHA 2012). See Section 4.0 for a list of references.

2.2 Test Species

When necessary, *M. beryllina* were acclimated to approximate test conditions prior to use in the assay. Test organisms were transferred to test chambers using an inverted glass pipet, minimizing the amount of water added to test solutions. Twenty control fish were weighed during the test to confirm loading rates. The loading rate was below the maximum 0.4 g/L recommended for assays conducted at 25˚C. Fish weights and loading calculations are included in Appendix A.

2.3 Effluent, Receiving Water and Laboratory Water

Effluent and receiving water collection information is provided in Table 1. Samples were received at 0-6˚C as per 40 CFR §136.3 unless otherwise noted, stored at 4±2˚C and warmed to 25±1˚C prior to preparing test solutions. Effluent used in the *M. beryllina* assay was salinity adjusted to 25±2 ppt using artificial sea salts according to protocol (US EPA 2002). Laboratory water was collected from the Hampton/Seabrook Estuary. This water has been used to culture marine test organisms since 1981.

Total residual chlorine (TRC) was measured by amperometric titration (MDL 0.02 mg/L) in the effluent and diluent samples prior to use in the assays. Samples with ≥0.02 mg/L TRC were dechlorinated using sodium thiosulfate (US EPA 2002) and a control treatment using laboratory water adjusted with the same amount of sodium thiosulfate used to dechlorinate the effluent was run concurrently with the assay. If sample pH measured <6.0 SU or >9.0 SU, samples were adjusted using sodium hydroxide or hydrochloric acid, respectively, and a control treatment using laboratory water adjusted with the same amount of either

compound used to modify sample pH was run concurrently with the assay. When applicable, data from sodium thiosulfate and/or pH adjusted laboratory control treatments can be found in Appendix A.

2.4 Acute Exposure Bioassay

Test concentrations for the assay were 100%, 50%, 25%, 12.5%, and 6.25% effluent. The 48-hour static acute toxicity test was conducted at 25±1˚C with a photoperiod of 16:8 hours light:dark. Test chambers were 250 mL glass beakers containing 200 mL test solution in each of 4 replicates with 10 organisms/replicate. Replicates were not randomized during testing; rather, organisms were added randomly at test initiation by replicate across test solutions in an alternating fashion (alternating allocation). Survival and dissolved oxygen were recorded daily in all replicates. Salinity, temperature, and pH were measured daily in one replicate of each test treatment.

2.5 Data Analysis

When applicable, statistical analysis of acute exposure data was completed using CETIS™ v1.9.6.3, Comprehensive Environmental Toxicity Information System, software. The program computes acute exposure endpoints based on US EPA decision tree guidelines specified in individual test methods. If survival in the highest test concentration is >50%, the LC-50 is obtained by direct observation of the raw data. As needed, the A-NOEC is determined as the highest test concentration that caused no significant mortality.

2.6 Quality Control

As part of the laboratory quality control program, standard reference toxicant assays are completed on a regular basis for each test species. These results provide relative health and response data while allowing for comparison with historic data sets. See Table 2 for details.

3.0 RESULTS AND DISCUSSION

Results of the acute exposure bioassay completed using the inland silverside are summarized in Table 3. Effluent and dilution water characteristics are presented in Table 4. US EPA Region I toxicity test summary sheets can be found after the tables. Support data, including copies of laboratory bench sheets, are included in Appendix A.

Minimum test acceptability criteria require ≥90% survival in the control concentrations. Achievement of these results indicates that healthy test organisms were used and that the dilution water had no significant adverse impact on the outcome of the assay. See the Executive Summary and Table 3 for test acceptability.

4.0 LITERATURE CITED

40 CFR §136.3. *Code of Federal Regulations* (CFR), Protection of the Environment (Title 40), Guidelines Establishing Test Procedures for the Analysis of Pollutants (Part 136), Identification of Test Procedures (sub-part 3), Table II-Required Containers, Preservation Techniques, and Holding Times.

APHA. 2012. *Standard Methods for the Examination of Water and Wastewater*, 22nd Edition. Washington D.C.

The NELAC Institute (TNI). 2009. *Environmental Laboratory Sector, Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis (TNI Standard)*. EL-V1-2009.

US EPA 2002. *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*. Fifth Edition. EPA-821-R-02-012.

US EPA Region I. 2012. *Marine Acute Toxicity Test Procedure and Protocol*. US EPA Region I Office, Boston, Massachusetts. November 2012.

TABLE 1. Sample Collection Information.
Hull WPCF Effluent Biomonitoring Evaluation. November 2020.

		Collection		Receipt		Receipt
Sample Description	Type	Date	Time	Date	Time	Temp ˚C
Effluent	Comp	11/17-18/20	0800-0800	11/18/20	1200	9 [a]
Receiving Water	Grab	11/18/20	0600	11/18/20	1200	9 [a]

COMMENTS:
[a] Upon receipt, the temperature was outside of the range of 0-6°C per 40 CFR §136.3 for NPDES effluent samples and support chemistry samples. Samples were received with ice in the cooler, and were picked up and hand delivered by Enthalpy's courier the day sampling was completed.

TABLE 2. Reference Toxicant Data.
Hull WPCF Effluent Biomonitoring Evaluation. November 2020.

Date	Organism Lot	Endpoint	Value	Historic Mean/ Tendency	Acceptable Range	Reference Toxicant
M. beryllina						
11/17/20	13MbABS111720	Survival: 48Hr LC-50	30.0	50.6	22.1 – 79.1	Ammonia(mg/L)

Means and Acceptable Ranges based on the 20 most recent reference toxicant assays.

TABLE 3. Acute Evaluation Results.
Hull WPCF Effluent Biomonitoring Evaluation. November 2020.

Percent Survival

Species	Exposure	Lab	RW	6.25%	12.5%	25%	50%	100%
M. beryllina	48 hours	100%	100%	97.5%	95%	100%	95%	100%

LC-50 and A-NOEC Results

Species	Exposure	Spearman-Karber	Linear Interpolation	Direct Observation	A-NOEC
M. beryllina	48 Hours	NC	NC	>100%	NC

COMMENTS:
NC = Not Calculated.

TABLE 4. Effluent and Diluent Characteristics.
Hull WPCF Effluent Biomonitoring Evaluation. November 2020.

PARAMETER	UNIT	EFFLUENT	RECEIVING WATER
pH - As Received	SU	7.03	7.80
Salinity - As Received	ppt	10	33
Total Residual Chlorine	mg/L	0.009 [a]	<0.02
Total Solids	mg/L	10000	35000
Total Suspended Solids	mg/L	17	4.2
Ammonia as N	mg/L	1.11	0.23
Total Organic Carbon	mg/L	10.2	1.8
Aluminum, total	mg/L	0.056	0.062
Cadmium, total	mg/L	<0.0003	<0.0005
Calcium, total	mg/L	138	384
Chromium, total	mg/L	<0.001	<0.002
Copper, total	mg/L	0.035	0.0053
Lead, total	mg/L	0.0004	<0.0005
Magnesium, total	mg/L	332	1180
Nickel, total	mg/L	0.0019	<0.002
Zinc, total	mg/L	0.12	0.0041

COMMENTS:
Additional water quality and chemistry data are available in Appendix A.
[a] The total residual chlorine was 0.009 mg/L upon receipt but was <0.02 mg/L after salinity adjustment, therefore adjustment with sodium thiosulfate was not necessary.

TOXICITY TEST SUMMARY SHEET

FACILITY NAME:	Hull WPCF	TEST START DATE:	11/19/20
NPDES PERMIT NO.:	MA0101231	TEST END DATE:	11/21/20

TEST TYPE		TEST SPECIES		SAMPLE TYPE		SAMPLE METHOD	
X	Acute		*Pimephales promelas*		Prechlorinated		Grab
	Chronic		*Ceriodaphnia dubia*		Dechlorinated	X	Composite
	Modified Chronic (Reporting Acute Values)		*Daphnia pulex*		Chlorine Spiked in Lab		Flow-thru
			Americamysis bahia	X	Chlorinated on Site		Other
			Cyprinodon variegatus		Unchlorinated		
	24 Hour Screen	X	*Menidia beryllina*		No Detectable Chlorine Upon Receipt		
			Arbacia punctulata				

DILUTION WATER:

X Receiving water collected at a point upstream or away from the discharge, free from toxicity or other sources of contamination; Receiving Water Name: Massachusetts Bay

____ Alternate surface water of known quality and hardness, to generally reflect the characteristics of the receiving water; Receiving Water Name:

____ Synthetic water prepared using either Millipore Milli-Q or equivalent deionized water and reagent grade chemicals; or deionized water combined with mineral water.

____ Artificial sea salts mixed with deionized water

____ Deionized water and hypersaline brine

____ Other

EFFLUENT SAMPLING DATES: 11/17-18/20

EFFLUENT CONCENTRATIONS TESTED (%): 100, 50, 25, 12.5, 6.25

Permit Limit Concentration: ≥100 %

Was the effluent salinity adjusted? Yes If yes, to what level? 25 ppt

REFERENCE TOXICANT TEST DATE: 11/17/20 LC-50: 30.0 mg/L Ammonia

PERMIT LIMITS AND TEST RESULTS

Test Acceptability Criteria

Mean Diluent Control Survival: 100 %

LIMITS		**RESULTS**	
LC-50:	≥100 %	LC-50	>100 %
		Upper Limit:	- %
A-NOEC:	- %	Lower Limit:	- %
		Method:	Direct Observation
IC- ____	- %	A-NOEC	- %
		IC- ____	%

APPENDIX A

DATA SHEETS

STATISTICAL SUPPORT

Contents	Number of Pages
Methods Used in NPDES Permit Biomonitoring Testing	1
Massachusetts DEP Accreditation Certification and Certified Parameter List	2
M. beryllina Acute Bioassay Bench Sheets	2
M. beryllina Reference Toxicant Analysis	1
M. beryllina Wet Weights	0
M. beryllina Organism Culture Sheet	1
Preparation of Dilutions and Record of Meters Used	1
Analytical Chemistry Report	1
Sample Receipt Record	1
Chain of Custody	2
Assay Review Checklist	1
Total Appendix Pages	13

METHODS USED IN NPDES PERMIT BIOMONITORING TESTING

Parameter	Method
Acute Exposure Bioassays:	
Ceriodaphnia dubia	EPA-821-R-02-012 2002.0
Daphnia pulex	EPA-821-R-02-012 2021.0
Pimephales promelas	EPA-821-R-02-012 2000.0
Americamysis bahia	EPA-821-R-02-012 2007.0
Menidia beryllina	EPA-821-R-02-012 2006.0
Cyprinodon variegatus	EPA-821-R-02-012 2004.0
Chronic Exposure Bioassays:	
Ceriodaphnia dubia	EPA-821-R-02-013 1002.0
Pimephales promelas	EPA-821-R-02-013 1000.0
Cyprinodon variegatus	EPA-821-R-02-014 1004.0
Menidia beryllina	EPA-821-R-02-014 1006.0
Arbacia punctulata	EPA-821-R-02-014 1008.0
Champia parvula	EPA-821-R-02-014 1009.0
Trace Metals:	
Trace Metals	EPA 200.8/SW 6020, EPA 245.7
Hardness	EPA SW846 3rd Ed. 6010
Wet Chemistries:	
Alkalinity	EPA 310.2
Chlorine, Residual	Standard Methods 22nd Edition - Method 4500-Cl D
Total Organic Carbon	Standard Methods 22nd Edition - Method 5310 C
Specific Conductance	Standard Methods 22nd Edition - Method 2510 B
Nitrogen - Ammonia	Standard Methods 22nd Edition - Method 4500-NH_3 G
pH	Standard Methods 22nd Edition - Method 4500-H+ B
Solids, Total (TS)	Standard Methods 22nd Edition - Method 2540 B
Solids, Total Dissolved (TDS)	Standard Methods 22nd Edition - Method 2540 C
Solids, Total Suspended (TSS)	Standard Methods 22nd Edition - Method 2540 D
Dissolved Oxygen	Standard Methods 22nd Edition - Method 4500-O G

Please visit our web site at www.enthalpy.com/accreditations for a copy of our accreditations and state certifications.

The Commonwealth of Massachusetts

Department of Environmental Protection

Division of Environmental Laboratory Sciences
Senator William X. Wall Experiment Station

certifies

M-NH906

ENTHALPY ANALYTICAL, LLC
1 LAFAYETTE RD
UNIT 6
HAMPTON, NH 03842-0000

Laboratory Director: **JASON HOBBS**

for the analysis of **NON POTABLE WATER (CHEMISTRY)**

pursuant to 310 CMR 42.00

This certificate supersedes all previous Massachusetts certificates issued to this laboratory. The laboratory is regulated by and shall be responsible for being in compliance with Massachusetts regulations at 310 CMR 42.00.

This certificate is valid only when accompanied by the latest dated Certified Parameter List as issued by the Massachusetts D.E.P. Contact the Division of Environmental Laboratory Sciences to verify the current certification status of the laboratory.

Certification is no guarantee of the validity of the data. This certification is subject to unannounced laboratory inspections.

Oscar C. Parcaba

Director, Division of Environmental Laboratory Sciences

Issued: **01 JUL 2020**

Expires: **30 JUN 2021**

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Certified Parameter List as of: 01 JUL 2020

M-NH906 **ENTHALPY ANALYTICAL, LLC**
HAMPTON NH

NON POTABLE WATER (CHEMISTRY) **Effective Date** **01 JUL 2020** **Expiration Date** **30 JUN 2021**

Analytes	Methods
ALUMINUM	EPA 200.8
ANTIMONY	EPA 200.8
ARSENIC	EPA 200.8
BERYLLIUM	EPA 200.8
CADMIUM	EPA 200.8
CHROMIUM	EPA 200.8
COBALT	EPA 200.8
COPPER	EPA 200.8
IRON	EPA 200.8
LEAD	EPA 200.8
MANGANESE	EPA 200.8
MERCURY	EPA 245.7
MOLYBDENUM	EPA 200.8
NICKEL	EPA 200.8
SELENIUM	EPA 200.8
SILVER	EPA 200.8
THALLIUM	EPA 200.8
VANADIUM	EPA 200.8
ZINC	EPA 200.8
PH	SM 4500-H-B
SPECIFIC CONDUCTIVITY	SM 2510B
TOTAL DISSOLVED SOLIDS	SM 2540C
ALKALINITY, TOTAL	EPA 310.2
AMMONIA-N	SM 4500-NH3-B, G
NITRATE-N	SM 4500-NO3-F
ORTHOPHOSPHATE	SM 4500-P-E
PHOSPHORUS, TOTAL	SM 4500-P-B,E
BIOCHEMICAL OXYGEN DEMAND	SM 5210B
NON-FILTERABLE RESIDUE	SM 2540D
OIL AND GREASE	EPA 1664

June 1, 2020 ***= Provisional Certification** **Page 1 of 1**

ACUTE BIOASSAY DATA SUMMARY (page 1 of 2)

Study Number: 34676	Brine Shrimp: A- G049	"As Received" Effluent and Diluent Chemistries							
Client: Woodard & Curran	Test Organism: *M. beryllina*		T. Metals	TOC	AMM	TS/TSS	pH	S/C	Salinity	TRC
Sample: Hull WWTF Effluent	Organism Supplier / Batch / Age: *See Organism Culture Sheet*	Effluent:	002	003	004	005/006	7.03	14300	9.5	0.009
Diluent: Receiving Water		Diluent:	009	010	011	012/013	7.80	44600	32.78	<0.02

Salinity Adjustment Record: 4000 mL Effluent + 71.4 G Sea Salts (A- 5837) = 100% Actual Percentage (23)CFS 11/18
4000 mL Diluent + 1,400 mL DI Water = 74.1% Actual Percentage

Conc	Rep	Survival 0	Survival 24	Survival 48	DO (mg/L) 0	DO (mg/L) 24	DO (mg/L) 48	pH (SU) 0	pH (SU) 24	pH (SU) 48	Temp (°C) 0	Temp (°C) 24	Temp (°C) 48	Salinity (ppt) 0	Salinity (ppt) 24	Salinity (ppt) 48
Lab Salt	A	10	10	10	7.7	5.0	5.7	7.90	7.42	7.55	23	23	23	26	26	27
	B	10	10	10	7.7	5.4	6.1									
	C	10	10	10	7.7	5.3	6.1									
	D	10	10	10	7.7	5.3	6.2									
RW	A	10	10	10	8.6	5.4	6.1	7.89	7.53	7.63	24	23	23	25	26	26
	B	10	10	10	8.6	5.3	6.0									
	C	10	10	10	8.6	5.3	6.1									
	D	10	10	10	8.6	5.2	6.2									
6.25%	A	10	10	9	8.4	5.3	6.1	7.87	7.55	7.67	24	23	23	25	26	26
	B	10	10	10	8.4	5.1	6.1									
	C	10	10	10	8.4	5.3	5.9									
	D	10	10	10	8.4	5.2	6.1									
12.5%	A	10	9	9	8.5	5.4	5.9	7.86	7.66	7.70	23	23	23	25	26	27
	B	10	10	10	8.5	5.4	6.1									
	C	10	10	9	8.5	5.6	6.1									
	D	10	10	10	8.5	5.2	6.0									
Inc ID:		TCR 200	TCR 200	TCR 200												
Inc. Temp (°C):		25	25	25												
Date:		11/19/20	11/20/20	11/21	11/19/20	11/20/20	11/21/20									
Time:		1040	1115	1230	1015	1040	1210									
Initials:		CMC	BG	CFS	GRS	JTP	CFS									
WQ Station Used:					2	1	2									

ACUTE BIOASSAY DATA SUMMARY (page 2 of 2)

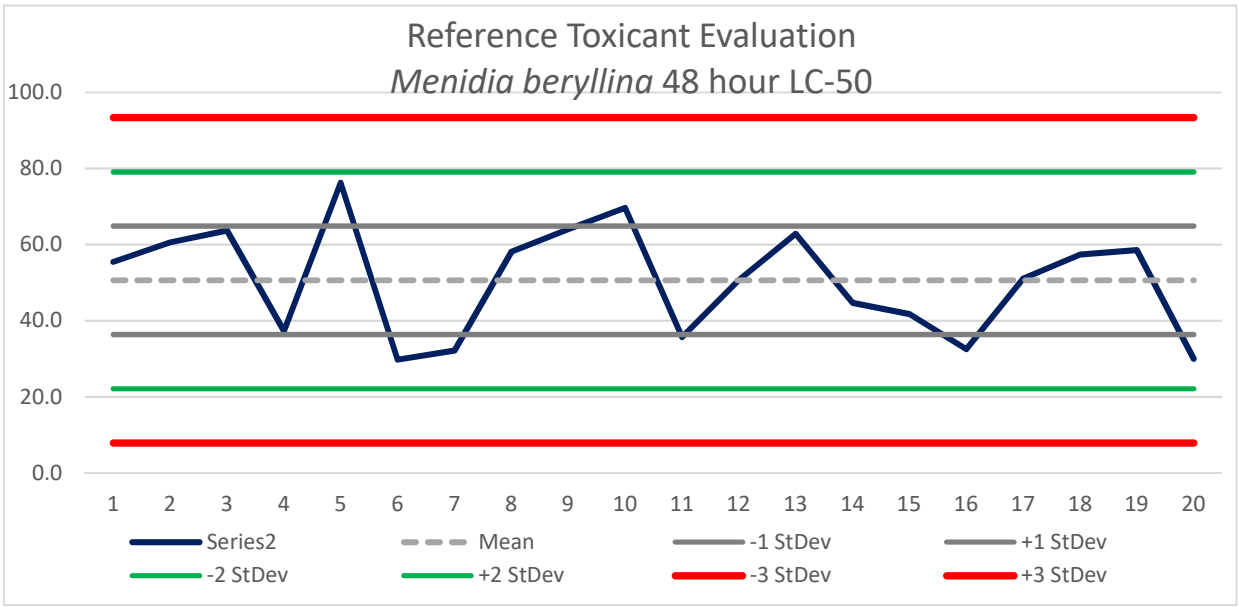
Study Number: 34676	
Client: Woodard & Curran	Test Organism: *M. beryllina*
Sample: Hull WWTF Effluent	Organism Supplier / Batch / Age: *See Organism Culture Sheet*
Diluent: Receiving Water	

Conc	Rep	Survival 0	Survival 24	Survival 48	DO (mg/L) 0	DO (mg/L) 24	DO (mg/L) 48	pH (SU) 0	pH (SU) 24	pH (SU) 48	Temp (°C) 0	Temp (°C) 24	Temp (°C) 48	SALINITY (ppt) ~~pH (SU)~~ EB 11/21 0	SALINITY (ppt) ~~pH (SU)~~ EB 11/21 24	SALINITY (ppt) ~~pH (SU)~~ EB 11/21 48
25%	A	10	10	10	8.5	5.6	6.1	7.82	7.68	7.78	24	23	23	25	26	27
	B	10	10	10	8.5	5.2	5.9									
	C	10	10	10	8.5	5.5	6.0									
	D	10	10	10	8.5	5.6	6.2									
50%	A	10	9	9	8.6	5.6	6.1	7.75	7.75	7.83	24	23	23	25	26	27
	B	10	10	10	8.6	5.7	6.0									
	C	10	10	10	8.6	5.6	5.8									
	D	10	10	9	8.6	5.9	6.0									
100%	A	10	10	10	9.4	5.5	5.8	7.63	7.84	7.93	24	23	24	25	26	27
	B	10	10	10	9.4	5.6	5.7									
	C	10	10	10	9.4	5.7	5.8									
	D	10	10	10	9.4	5.7	5.8									
Inc ID:		TCR 200	TCR 200	TCR 200												
Inc. Temp (°C):		25	25	25												
Date:		11/19/20	11/20/20	11/21/20	11/19/20	11/20/20	11/21/20									
Time:		1040	1115	1230	1015	1040	1210									
Initials:		CMC	BG	CFS	GRS	JTP	CFS									
WQ Station Used:					2	1	2									

STANDARD REFERENCE TOXICANT ANALYSIS

Exposure: Acute - 48 Hours
Species: Menidia beryllina
Toxicant: Ammonium Chloride
Temperature: 25C
Long Term Mean: 50.6 mg/L
Long Term CV: 0.3

Date		LC-50	Mean	Std Dev	2 Std Dev	CV	Mean -1 Std	Mean +1 Std	Mean -2 Std	Mean +2 Std	Mean -3 Std	Mean +3 Std
6/20/2019	1	55.5	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
7/31/2019		60.6	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
8/20/2019		63.7	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
9/24/2019		37.3	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
10/1/2019	5	76.3	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
11/5/2019		29.8	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
12/3/2019		32.2	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
12/27/2019		58.2	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
1/28/2020		64.1	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
2/20/2020	10	69.7	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
2/27/2020		35.7	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
3/25/2020		50.7	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
4/29/2020		62.9	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
6/2/2020		44.7	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
7/23/2020	15	41.8	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
7/28/2020		32.5	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
8/27/2020		51.1	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
9/29/2020		57.4	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
10/27/2020		58.6	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38
11/17/2020	20	30.0	50.64	14.25	28.50	28.14	36.39	64.89	22.14	79.14	7.90	93.38



Issued By: Reviewed By:

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

07M6ABS111320

Toll Free: 800/331-5916
Tel: 970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 11/12/2020

SPECIES: *Menidia beryllina*

AGE: 6 day

LIFE STAGE: Juvenile

HATCH DATE: 11/6/2020

BEGAN FEEDING: Immediately

FOOD: Rotifers, *Artemia* sp.

Water Chemistry Record:	**Current**	**Range**
TEMPERATURE:	25°C	23-26 °C
SALINITY/CONDUCTIVITY:	25 ppt	24-27 ppt
TOTAL HARDNESS (as $CaCO_3$):	--	--
TOTAL ALKALINITY (as $CaCO_3$):	170 mg/l	145-200 mg/l
pH:	8.05	7.71-8.14

Comments:

Facility Supervisor

DILUTIONS PREPARATIONS

Study Number 34676	Client: Woodard & Curran	
Species: *M. beryllina*	Thermometer ID: T-295	
Diluent: Receiving Water	Day: 0 Start E_o = 24.8°C D_o = 25.2°C Sample: E_o, D_o	
Concentration %	Volume Effluent (mLs)	Final Volume (mLs)
Lab Salt	0	800
RW	0	↓
6.25%	50	
12.5%	100	
25%	200	
50%	400	
100%	800	
Initials:	CFS	
Date:	11/19/20	
Time:	0955	

Water Quality Station # 1		Water Quality Station # 2	
Meter ID:	ML01	Meter ID:	ML02
DO Probe ID:	96	DO Probe ID:	160
pH Probe ID:	170	pH Probe ID:	171
S/C Probe ID:	159	S/C Probe ID:	1

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Report No: 34676 SDG:
Project: Hull

Sample ID: Effluent Start
Matrix: Water
Sampled: 11/18/20 0800

Parameter		Result	Quant Limit	Units	Date Prepared	Date of Analysis	INIT/Method/Reference
Total solids	34676-006	10000	100	mg/L	11/24/20 1625	12/01/20 1240	BG /SM 2540B
Total suspended solids	34676-005	17	1	mg/L	11/24/20 1445	12/01/20 1150	JTP/SM 2540D
Total organic carbon	34676-003	10.2	0.4	mg/L	11/23/20 1245	11/23/20 1315	AS /SM 5310 B
Ammonia-N	34676-004	1.11	0.1	mg/L as N	11/20/20 1340	11/20/20 1340	AS /SM 4500-NH3 G
Aluminum, total	34676-002	0.056	0.02	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8
Cadmium, total	34676-002	ND	0.0003	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8
Calcium, total	34676-002	138	0.1	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8
Chromium, total	34676-002	ND	0.001	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8
Copper, total	34676-002	0.035	0.0005	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8
Lead, total	34676-002	0.0004	0.0003	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8
Magnesium, total	34676-002	332	0.1	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8
Nickel, total	34676-002	0.0019	0.001	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8
Zinc, total	34676-002	0.12	0.002	mg/L	11/30/20 0850	12/02/20 1312	AS /EPA 200.8

Sample ID: Receiving Water Start
Matrix: Water
Sampled: 11/18/20 0600

Parameter		Result	Quant Limit	Units	Date Prepared	Date of Analysis	INIT/Method/Reference
Total solids	34676-013	35000	200	mg/L	11/24/20 1625	12/01/20 1240	BG /SM 2540B
Total suspended solids	34676-012	4.2	1	mg/L	11/24/20 1445	12/01/20 1150	JTP/SM 2540D
Total organic carbon	34676-010	1.8	0.4	mg/L	11/23/20 1245	11/23/20 1315	AS /SM 5310 B
Ammonia-N	34676-011	0.23	0.1	mg/L as N	11/20/20 1341	11/20/20 1341	AS /SM 4500-NH3 G
Aluminum, total	34676-009	0.062	0.02	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8
Cadmium, total	34676-009	ND	0.0005	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8
Calcium, total	34676-009	384	0.2	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8
Chromium, total	34676-009	ND	0.002	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8
Copper, total	34676-009	0.0053	0.0005	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8
Lead, total	34676-009	ND	0.0005	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8
Magnesium, total	34676-009	1180	0.2	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8
Nickel, total	34676-009	ND	0.002	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8
Zinc, total	34676-009	0.0041	0.002	mg/L	11/30/20 0850	12/02/20 1331	AS /EPA 200.8

Notes:

ND = Not Detected

SAMPLE RECEIPT AND CONDITION DOCUMENTATION

STUDY NO:	34676		
SDG No:	Hull		
Project:	Hull		
Delivered via:	Enthalpy		
Date and Time Received:	11/18/20 1355	Date and Time Logged into Lab:	11/18/20 1500
Received By:	RS	Logged into Lab by:	CFS CFS
Air bill / Way bill:	NA	Cooler on ice/packs:	Yes
Custody Seals present/intact	NA	Cooler blank temp (C) at arrival:	3.6
		Thermometer ID:	T-295
Number of COC Pages:	2		
		Were VOC vials free of headspace?	NA
COC Complete:	Yes	pH Test strip lot ID:	A-6003

Were samples received within holding time? Yes
Does the info on the COC match the samples? Yes

Client notification/authorization: NA

Field ID	Lab ID	Mx	Analysis Requested	Bottle	Req'd Pres'n	Verified Pres'n
Effluent Start	34676-001	W	MB48AD StartSample	1x3750 P	4 C	Yes
Effluent Start	34676-002	W	Total Metals Cd,Cr,Ni,Pb,Cu,Zn,Al,Ca,Mg;	250 P	HNO3	Yes
Effluent Start	34676-003	W	TOC	1x40 G	4 C	Yes
Effluent Start	34676-004	W	NH3;	125 P	H2SO4	Yes
Effluent Start	34676-005	W	TSS	1000 P	4 C	Yes
Effluent Start	34676-006	W	TS	250 P	4 C	Yes
Effluent Start	34676-007	W	As Received	500 P	4 C	Yes
Receiving Water Start	34676-008	W	MB48AD StartDiluent	2x3750 P	4 C	Yes
Receiving Water Start	34676-009	W	Total Metals Cd,Cr,Ni,Pb,Cu,Zn,Al,Ca,Mg;	250 P	HNO3	Yes
Receiving Water Start	34676-010	W	TOC	1x40 G	4 C	Yes
Receiving Water Start	34676-011	W	NH3;	125 P	H2SO4	Yes
Receiving Water Start	34676-012	W	TSS	1000 P	4 C	Yes
Receiving Water Start	34676-013	W	TS	250 P	4 C	Yes
Receiving Water Start	34676-014	W	As Received	500 P	4 C	Yes

Notes and qualifications:

See COC

EA

Enthalpy Analytical
1 Lafayette Road
Hampton, NH 03842

Voice: 603-926-3345

Enthalpy Job No: 34676

CHAIN OF CUSTODY DOCUMENTATION

Client:	Woodard and Curan - Hull	Contact:	Aram Varjabedian	Project Name:	Hull WWTF
Report to:	Aram Varjabedian	Address:	1111 Nantasket Avenue	Project Number:	P0036
Task:	0001				
Invoice to:	Aram Varjabedian	Address:	Hull, MA 02045	Project Manager:	Aram Varjabedian
Voice:	781-925-0906	Fax:	781-925-3056	email:	0
P.O:	'				

Lab Number (assigned by lab)	Your Field ID: (must agree with container)	Date Sampled	Time Sampled	Sampled By	Grab or composite (G/C)	Container No	Container Size (mL)	Container Type (P/G/T)	Field Preservation	Matrix S=Solid W=Water	Filter N=Not needed F=Done in field L=Lab to do	Analyses Requested\ Special Instructions:
001	Effluent Start	11/17-18/20	8A-8A		C	1	3750	P	4 C	Water	N	MB48AD StartSample
002	Effluent Start	11/17-18/20	8A-8A		C	1	250	P	HNO3	Water	N	Total Metals Cd,Cr,Ni,Pb,Cu,Zn,Al,Ca,Mg;
003	Effluent Start	11/17-18/20	8A-8A		C	1	40	G	4 C	Water	N	TOC
004	Effluent Start	11/17-18/20	8A-8A		C	1	125	P	H2SO4	Water	N	NH3;
005	Effluent Start	11/17-18/20	8A-8A		C	1	1000	P	4 C	Water	N	TSS
006	Effluent Start	11/17-18/20	8A-8A		C	1	250	P	4 C	Water	N	TS
007	Effluent Start	11/17-18/20	8A-8A		C	1	500	P	4 C	Water	N	As Received

Relinquished By: [signature] Date: 11/18/20 Time: 1200 Received By: [signature] Date: 11/18/20 Time: 1200 Temp (C): 5.8 Meter ID: T36

Relinquished By: [signature] Date: 11/18/20 Time: 1353 Received at Lab By: [signature] Date: 11/18/20 Time: 1353 Temp (C): 3.6 Meter ID: T-295

Comments:

COC Number: A1019407

Page of

Hull WPCF Effluent Biomonitoring Program, November 2020.
Study Number 34676.

Data Appendix Page 11

EA
Enthalpy Analytical
1 Lafayette Road
Hampton, NH 03842
Voice: 603-926-3345

Enthalpy Job No: 34676

CHAIN OF CUSTODY DOCUMENTATION

Client:	Woodard and Curan - Hull	Contact:	Aram Varjabedian	Project Name:	Hull WWTF
Report to:	Aram Varjabedian	Address:	1111 Nantasket Avenue	Project Number:	P0036
Task:	0001				
Invoice to:	Aram Varjabedian	Address:	Hull, MA 02045	Project Manager:	Aram Varjabedian
Voice:	781-925-0906	Fax:	781-925-3056	email:	0
P.O:	'				

Lab Number (assigned by lab)	Your Field ID: (must agree with container)	Date Sampled	Time Sampled	Sampled By	Grab or com-posite (G/C)	Container No	Container Size (mL)	Container Type (P/G/T)	Field Preser-vation	Matrix S=Solid W=Water	Filter N=Not needed F=Done in field L=Lab to do	Analyses Requested\ Special Instructions:
008	Receiving Water Start	11/18/20	6:00 AM		G	2	3750	P	4 C	Water	N	MB48AD StartDiluent
009	Receiving Water Start	11/18/20	6:00 AM		G	1	250	P	HNO3	Water	N	Total Metals Cd,Cr,Ni,Pb,Cu,Zn,Al,Ca,Mg;
010	Receiving Water Start	11/18/20	6:00 AM		G	1	40	G	4 C	Water	N	TOC
011	Receiving Water Start	11/18/20	6:00 AM		G	1	125	P	H2SO4	Water	N	NH3;
012	Receiving Water Start	11/18/20	6:00 AM		G	1	1000	P	4 C	Water	N	TSS
013	Receiving Water Start	11/18/20	6:00 AM		G	1	250	P	4 C	Water	N	TS
014	Receiving Water Start	11/18/20	6:00 AM		G	1	500	P	4 C	Water	N	As Received

Relinquished By: [signature] Date: 11/18/20 Time: 1200 Received By: [signature] Date: 11/18/20 Time: 1200 Temp (C): 3.6 Meter ID: T306

Relinquished By: [signature] Date: 11/18/20 Time: 1355 Received at Lab By: [signature] Date: 11/18/20 Time: 1355 Temp (C): 3.6 Meter ID: T-295

Comments:

COC Number: A1019407

Page of

Assay Review Checklist

DATE IN: 11/18/20
DATE DUE: 12/31/20

STUDY#: 34676
CLIENT: Woodard and Curran
PROJECT: Hull
ASSAY: MB48AD

Project Paperwork Check for Completeness				
	Date	**Analyst**	**Supervisor**	**Comments**
Day 0	11/19/20	CMC	JTP	
Day 1	11/20/20	BG	BG	
Day 2	11/21/20	CFS	BG	
Day 3				
Day 4				
Day 5				
Day 6				
Day 7				
Day 8				

Analyst Data Review	**Date**	**Initials**	**Comments**
Chains of Custody Complete	11/28/20	BG	
Sample Receipt Complete	↓	↓	
Organism Culture Sheet(s)	↓	↓	
Bench Sheets Complete (dates, times, initials, etc...)	↓	↓	
Water Quality Data Complete	↓	↓	
TRC Values & Bottle Numbers	↓	↓	
Daphnid Calculations Complete	↓	NA	
Weights Reported	↓	BG	
Assay Acceptability Review	↓	↓	

Technical Report Review	**Date**	**Initials**	**Comments**
Statistical Analysis Complete	NA		
Statistical Analysis Reviewed	↓		
Data Acceptability Review	11/23/20	MW	
Supporting Chemistry Report	12/4/20	↓	
Draft Report	11/23/20	MW	
QA Audit/Review Complete			
Final Report Reviewed	12/3/20	NR	Needs chems
Final Report Printed - PDF	12/4/20	MW	
Executive Summary / Chems Sent			
Report E-mailed / Faxed	12/4/20	MW	
Report Logged Out / Invoice Sent	↓	↓	
Report Scanned to Archive	↓	↓	

Q:\Forms\Lab Forms\Sampling & Receipt\Assay Review Checklist 06-13-19.wpd

Michael J Salema

Digitally signed by Michael J Salema
DN: cn=Michael J Salema, o=Enthalpy Analytical, ou=QA Director, email=mike.salema@enthalpy.com, c=US
Date: 2020.06.23 15:36:06 -04'00'